**Unit 5 In-Class review:**

1. Suppose that 84% of a sample of 125 nurses working 7 AM to 3 PM shifts in city hospitals express positive job satisfaction, while only 72% of a sample of 150 nurses on 11 PM to 7 AM shifts express similar fulfillment.  Establish a 90% confidence interval estimate for the difference and interpret.

*p*1 – proportion of nurses working day shifts

*p*2 – proportion of nurses working night shifts

Conditions:

1. Random – assume samples are representative of the populations
2. Independence – it is safe to assume that the samples would be independent of each other
3. 10% Condition – 125 nurses is less than 10% of all nurses working a day shift. 150 nurses is less than 10% of all nurses working a night shift.
4. Success/Failure - 



All conditions have been met to use the Normal model for a 2 proportion z-interval.

CI: 

CI: (0.0391, 0.2009)

We are 90% confident that the true proportion of nurses working a day shift who express positive job satisfaction is between 3.9% to 20.1% higher than for nurses working a night shift.

1. A doctor thinks that less than 30 percent of all persons exposed to a certain amount of radiation will feel any ill effects.  Only 9 of the 57 people exposed to such radiation felt any ill effects. Test the claim at the 0.05 level of significance.

H0: *p* = 0.30 The proportion of people exposed to the radiation that feel ill effects is 30%.

HA: *p* < 0.30 The proportion of people exposed to the radiation that feel ill effects is less than 30%.

Conditions:

1. Random – assume the sample is representative of the population
2. 10% Condition – 57 people exposed to the radiation is less than 10% of all people exposed to the radiation
3. Success/Failure - 



All conditions have been met to use the Normal model for a 1 proportion z-test.



P-Value = P(z < -2.341) = 0.0096

Since the P-Value is less than alpha (0.0096 < 0.05), we reject the null hypothesis. There is statistically significant evidence that the true proportion of people exposed to this radiation that feel ill effects is less than 30%.

1. Suppose in an election campaign a telephone poll of 800 registered voters under age 30 shows 460 in favor of the Republican candidate.  However a second poll shows only 520 of 1000 registered voters over age 30 favored the Republican candidate.  At the 1% significance level, is there sufficient evidence that the candidate’s popularity is different between the two age groups?

*p*1 – proportion of registered voters under age 30

*p*2 – proportion of registered voters over age 30

H0: *p*1 – *p*2 = 0 The proportion of registered voters under age 30 that favor the Republican candidate is the same for registered voters over age 30.

HA: *p*1 – *p*2 ≠ 0 The proportion of registered voters under age 30 that favor the Republican candidate is not the same for registered voters over age 30.

Conditions:

1. Random – assume samples are representative of the populations
2. Independence – it is safe to assume that the samples would be independent of each other
3. 10% Condition – 800 registered voters under age 30 is less than 10% of all registered voters under age 30. 1000 registered voters over age 30 is less than 10% of all registered voters over age 30.
4. Success/Failure - 



All conditions have been met to use the Normal model for a 2 proportion z-test.



P-Value = 2∙P(z > |2.328|) = 0.0199

Since the P-Value is greater than alpha (0.0199 > 0.01), we fail to reject the null hypothesis. There is not enough statistically significant evidence to say that the proportion of registered voters under 30 that favor the Republican candidate is different than for registered votes over the age 30.

1. In a random sample of machine parts, 18 out of 225 were found to have been damaged in shipment.  Establish a 95% confidence interval estimate for the proportion of machine parts that are damaged in shipment.

Conditions:

1. Random – stated as a random sample
2. 10% Condition – 225 machine parts is less than 10% of all machine parts
3. Success/Failure - 



All conditions have been met to use the Normal model for a 1 proportion z-interval.



(0.0446, 0.1155)

We are 95% confident that the true proportion of machine parts damaged in the shipment lies between 4.5% and 11.6%.

1. Go back to Problem #2 and answer the following questions:
2. Interpret your p-value in context of the problem

There is a 0.96% chance of getting a sample proportion of 15.7% or less if the true proportion of people exposed to this radiation that feel ill effects is 30%.

1. What would a Type I error be in context?

We state that the proportion of people exposed to this radiation that feel ill effects is less than 30% and it is still 30%.

1. What would a Type II error be in context?

We state that the proportion of people exposed to this radiation that feel ill effects is not less than 30% and it is less than 30%.

1. What would Power be in context?

The probability that we state that the proportion of people exposed to this radiation that feel ill effects is less than 30% and it is less than 30%.

1. Go back to Problem #1. Using your interval, does there appear to be a difference between the percent of nurses expressing positive job satisfaction during each shift?

Since 0 is not within the interval there is strong evidence of a difference between the proportion of nurses expressing positive job satisfaction between the two shifts.

1. Going back to problem #4: We want to estimate the true percent of defective machine parts with a 3% margin of error and 92% confidence. How many machine parts would we have to sample? Use the value sample proportion given in Problem #4 as a good estimate for the true proportion.



1. I want to estimate the number of people who will respond “YES” to my survey question. I want a margin of error of 6% with 99% confidence. How many people do I need to sample?



1. I have a confidence interval that is (0.42, 0.57).
2. What is my sample proportion?



1. What is my margin of error?

ME = 0.075

1. If my sample size was 60, what is my level of confidence?



1. Going back to Problem #4, explain what 95% confidence means in context.

About 95% of random samples of size 225 will produce confidence intervals that contain the true proportion of machine parts damaged in the shipment.